CORRIDORS OF THE FUTURE
PHASE II APPLICATION

SECTION 2: CLEAR SOLUTION

SECTION 2: CLEAR SOLUTION

The I-70 dedicated truck lanes project set forth in this section demonstrates how this solution will address congestion by making the Corridor safer, more efficient, and more effective overall as a national route for travel and commerce.

Dedicated truck-only lane (TOL) facilities as proposed refer to lanes or entire highway segments that are for dedicated use by trucks. These lanes as proposed would be additions to the existing I-70 alignment.

Dedicated TOLs facilities as proposed refer to lanes or entire highway segments that are for dedicated use by trucks.

Evaluating the Economic Feasibility of Truck-Only Facilities (USDOT, March 2007) reports that most of the completed truck-only facilities, or new projects under development, have involved the short distance separation of trucks from passenger vehicles at interchanges or international border crossings. This application presents a new and innovative concept in the United States: development of segregated TOLs along the nearly 800 mile Corridor of I-70 between western Missouri and eastern Ohio.

This section:

1) Describes the Corridor-wide "vision" of the project and why dedicated truck lanes are a clear solution to:
   a. Congestion Reduction,
   b. Mobility Improvements,
   c. Economic Benefits and Support of Commerce, and
   d. Value to Users of the Corridor;
2) Clarifies why the new TOLs Corridor will attract trucks;
3) Discusses conceptual design and engineering issues; and
4) Identifies other potential strategies to be incorporated into the TOLs project.

2.1. CORRIDOR-WIDE "VISION" OF THE PROJECT

The Missouri, Illinois, Indiana, and Ohio Departments of Transportation (DOTs) have done well, maintaining the aging I-70 infrastructure as traffic volumes well exceed what the highway was designed to carry. Safety improvements throughout the Corridor have included geometric

upgrades, wider and brighter striping, median cable barriers, freeway reference markers, and deployment of freeway service patrols, amongst others. However, as traffic volumes increase and congestion grows, these supplemental measures provide minimal benefits as compared to the impact of separating truck and passenger car movements into their own dedicated lanes.

Heavy vehicles make up a Corridor average of 21.5 percent in urban areas and 27.5 percent in rural areas of the overall traffic on I-70 in Missouri, Illinois, Indiana, and Ohio. As this ratio of trucks to cars increases, so do the severity of crashes, level of congestion, and delay. By pursuing the I-70 Corridor of the Future project in unison, the states of Missouri, Illinois, Indiana and Ohio will be establishing a nearly 800 mile seamless, efficient and safe Corridor to facilitate the movement of goods throughout the Midwest.

While this Corridor may pose several challenges, it also provides opportunity for America's economic "big picture," enabling several levels of improved goods movement efficiency. I-70 TOLs represent a new logistics model for the nation and provide an opportunity to partner with a critical customer of roads – the trucking industry – to develop and implement a sound strategy. The I-70 dedicated TOLs project has the potential to address many of the key issues facing transportation systems today while providing mobility improvements to both the driving public and trucking community.

A dedicated truck corridor of this length can be designed to accommodate long haul trucks with larger and heavier loads and, with evolving technologies, it could provide opportunities for trucks to travel both safely and efficiently at higher speeds than current standards and infrastructure supports. A unified corridor of this length, designed in concert with intermodal linkages, freight transfer facilities, and truck staging areas, will enable larger freight loads to be transferred for long distances more efficiently and without conflicting truck size and weight standards. The segregation of trucks and passenger vehicles, and the application of new freight accommodations and efficiencies, will also present unique financing options for this Corridor, including such items as pay for use for greater weight, size, speed, etc. In the near term, the I-70 TOLs will provide for the safer and more efficient movement of goods. More importantly, allowing for the segregation of trucks over such a long distance, it could continue to serve for many years to come as a testing ground for new evolving technologies supporting electronic traffic management, freight movement, and other needs that have not yet been conceived. It will be a true "Corridor of the Future."

2.2. WHY DEDICATED TRUCK-ONLY LANES ARE THE SOLUTION

The proposed I-70 TOLs Corridor will increase the mobility of people and freight. Without improvement, much of the I-70 Corridor in Missouri, Illinois, Indiana and Ohio is expected to reach, or exceed, capacity by 2030. Adding general purpose travel lanes to this Corridor is not, in the long run, viewed as the most efficient solution to the capacity issue. Dedicated TOLs provide additional benefits beyond simply preserving system capacity. Dedicated TOLs will help improve the national logistics model and provide opportunities

to enhance the national economy, while improving safety and congestion in ways general purpose lanes cannot.

2.2.1. Freight Movement of the Future

The intent of this project is to accommodate and enable improved freight efficiencies such as making the Corridor a more attractive destination for long distance hauling. It is recognized that the separation of truck traffic will also make I-70 a safer, more attractive route for passenger vehicles as well.

A design for the future of freight movement should include assessment of the barriers encountered by the manufacturing and trucking industries in the transfer of goods and materials, as well as those barriers faced by complimentary modes of freight transfer. In addition to the more traditional design issues for the trucking of today, a corridor of this length with segregated truck lanes enables FHWA and the nation to assess entirely new concepts for the movement of freight via roadways.

If provided a clean or nearly clean slate, what would we do differently? Would trucks be heavier or longer, or should corridors such as this enable wider or taller loads? Should/could travel speeds be raised? If not, might navigational and operational technologies of the near future enable speeds, loads, and sizes on this corridor that would not even be considered today? Might it require a corridor of this size, designed to accommodate higher speeds and loads, to test the next stage of technologies needed to move the industry forward?

To assure that a grand opportunity is not missed, the partnering states for the I-70 Corridor propose to work with the FHWA not only in continued consultation with the American Trucking Associations (ATA), but also in engaging industrial freight shippers, information technology transportation researchers, and the rail and container shipping industries who provide and receive truck freight. The input of all components of the freight industry must be accounted for in the design of a true “Corridor of the Future.”

A corridor that attracts users also opens up new potential financing mechanisms. Could a corridor be made to be so attractive from an operational cost and efficiency perspective that users would go out of their way to use it and gladly pay tolls? Could the separation of lanes provide controls and safety mechanisms necessary for the testing of new transportation technologies? Would the providers of new pay for use technologies like freight networking, electronic communications and advertising, or other not yet developed technologies be willing to pay for the testing and use of their systems and infrastructure within the Corridor?

A unified long-haul freight corridor designed to complement existing intermodal linkages will enable goods movement efficiency.

2.2.2. I-70 Corridor – Connectivity Between Key Trade Destinations

I-70 holds a strategic location for goods movement. Via rail connections in Kansas City, Missouri and

Columbus, Ohio, the I-70 Corridor has seamless access to deep water ports on both east and west coasts. Via air connections in all major cities, the Corridor has connections to intercontinental markets. In addition, via highway connections, the Corridor is linked to Mexican and Canadian markets. The I-70 Corridor is an untapped route for strategic regional, U.S., and international goods movement. This corridor has the potential to become the trade corridor of the future. **Figure 2-1** illustrates the variety and location of intermodal facilities in the immediate vicinity of the I-70 Corridor.

Figure 2-1: Intermodal Facilities

Source: Wilbur Smith Generated Map

The beginning and ending points of this corridor are strategic; at one end is Kansas City, Missouri, and the eastern end is near Columbus, Ohio and ends near Pittsburgh, PA. Both Kansas City and Columbus are established and growing intermodal destinations that will benefit individually by the designation of this corridor as a TOLs corridor, and provide the ability for additional growth along the route as more and more companies choose to conduct business with companies located in these key cities.

Kansas City, Mo.: Geographically located in the center of the United States, Kansas City, Missouri is located at the crossroads of three of the nation's major interstates, I-29, I-35, and I-70. Using this strategic location to its advantage, Kansas City is hard at work to become the hub of an expanded international trade corridor between the United States, Mexico, and Canada. This city has been aggressively pursuing the North American International Trade Corridor to solidify its role as a transportation logistics and distribution hub for the country, and I-70 is one of the integral spokes in the North American Continent Trade Corridor.

Supporting Kansas City's efforts for increased trade with Mexico and Canada is its intermodal connectivity via air, land, and sea. Kansas City has the second-largest rail center in the nation, and its airport is the 33rd largest air cargo airport in the nation. The former Richards-Gebaur Air Force Base has been converted to an international trade facility called the International Freight Gateway. Kansas City also claims the largest Foreign Trade Zone in the United States, with more than 10,000 acres serving companies such as Bayer, Kawasaki, Pfizer, and Sony. Kansas City is also home to the world's largest underground business complex, Sub-Tropolis, comprised of nearly five million square feet of goods storage and distribution facilities. The city is also located on the Missouri/Mississippi River System, the nation's largest navigable inland waterway.

Columbus, Ohio: Strategically located within 500 miles, or a one-day truck trip, of more than half the U.S. population, Columbus, Ohio sits at a freight distribution nexus. Columbus is located at the crossroads of Interstates 70 and 71, and is working hard to ensure that it also sits at the crossroads of major rail networks. Norfolk Southern railroad has identified Columbus as a strategic point on its intermodal rail network and is developing a new intermodal facility in Columbus to connect with their "Heartland Corridor" initiative: a series of intermodal yards linked by a double-stack cleared rail line connecting Columbus, Ohio to the deep water port of Norfolk, Virginia.

This Norfolk Southern intermodal facility, which is part of the Heartland Rail Corridor, will be located at Rickenbacker International Airport as part of a developing Global Logistics Park (GLP). This GLP will be the hub of multimodal shipping activity in the Midwest, providing companies located in the Park a variety of shipping options, from truck to air to rail. An independent study, conducted for the intermodal yard development only, suggests that in the next 30 years 9,500 direct jobs and 10,900 indirect jobs will be created, as will 34 million additional square feet of industrial building development. From an economic standpoint, this translates into a $15.1 billion economic impact; more than $800 million in direct local, state and school district tax revenues; and $1.26 billion of indirect tax revenues. When combined with the addition of I-70 TOLs to support this development, it can be inferred that projected local benefits would be even greater. **Appendix A** includes a resolution of support from MORPC, the Columbus MPO, addressing this connectivity.

The many intermodal facilities and linkages that exist along the I-70 Corridor and the adjoining business communities will benefit economically from the proposed I-70 TOLs. These facilities will also serve to make the Corridor more attractive to additional freight

users looking at new options for moving their goods by more expedient or cost-effective means.

2.2.3. Shift in Trucking Operations - Alternatives that will Attract Trucks

TOLs, particularly on longer interstate corridors, can improve operating efficiencies for the trucking industry. As conceived, the I-70 "Corridor of the Future" will allow for seamless long-haul trucking operations over a nearly 800 mile stretch of highway. This distance will, in some cases, make the Corridor an attractive, cost-effective alternative to rail, enabling rail loads to be more cost-effectively transferred to trucks in Kansas City or Columbus, bypassing the significant rail congestion in Chicago that is a detriment to time-sensitive shipments.

A dedicated TOL corridor of this length can be designed to seamlessly accommodate longer, heavier, faster long-haul trucks.

Truck weight limits and configurations will be consistent throughout the length of the I-70 dedicated TOLs Corridor, reducing the need to break down loads at state lines. The prospect of deploying Longer Combination Vehicles (LCVs) also carries a cost savings. Described below are some of the truck-specific operational components that will be employed to target and encourage the use of the facility by trucks.

2.2.4. Longer Combination Vehicles

A cornerstone of the TOLs corridor, and key to the attractiveness of the route to trucks, will be the ability for the route to handle LCVs. In 1975, Congress established an allowable gross vehicle weight limit on the interstate system at 80,000 pounds and little has changed in the years since to allow good movement flexibility. The restrictions of these weight limits pose serious restraints on the extent of cargo that can be carried, and not only reduce the efficiency of distribution networks for commercial operators, but also increase the number of trucks that need to travel on roads to deliver goods.

Reporting by the Reason Foundation states, "the relaxation of gross vehicle weight limits on TOLs is essential to making highways safer while improving truck productivity. With more reasonable weight limits, freight could be moved more efficiently using fewer large trucks, which would, in turn, improve safety by reducing the number of trucks on the highways." As **Table 2-1** suggests, the movement of 500,000 pounds of freight between two points takes:

- Ten regular five-axle tractor/semi-trailer trips;
- Eight trips by a Canadian-style six-axle tractor/semi-trailer (three axles on the tractor plus three axles on a tridem semi-trailer);
- Seven trips by Rocky Mountain double;
- Six trips by a Canadian B double or a U.S. triple trailer; and

- Five trips by a turnpike double.

This illustrates that truck trips can be reduced by as much as 50 percent if LCVs are allowed to operate. Reason Foundation research also suggests that the corresponding reduction in the volume of truck traffic in addition to increasing the number axels, would reduce the wear and tear on the highway infrastructure.

Table 2-1: Comparative Productivity of Existing Truck Configurations

	Tractor/Semi-trailer	STAA Double	Canada tri-dem/semi	Rocky Mountain Double	Turnpike Double	Triple	Canada B-double
Configuration	3-S2	2-S1-T2	3-S3	3-S2-T2	3-S2-T4	2-S1-T2-T2	2-S3-S2
	5-axle	5-axle	6-axle	7-axle	9-axle	7-axle	8-axle
Trailers (ft)	To 53'	2x28'	48'	48+28'	2x48'	3x28'	2x32'
Gross wt. (000 lbs)	80	80	97	119	148	132	132
Empty wt. (000 lbs)	30	30	33	43	47	44	38
Payload (000 lbs)	50	50	64	76	101	88	94
Payload Ratio (relative to tractor/semi)	1.00	1.00	1.28	1.52	2.02	1.76	1.87
Trips to move 500,000-lb	10	10	8	7	5	6	6

Source: Toll Truckways: A New Path Toward Safer and More Efficient Freight Transportation, Reason Foundation

In a working paper entitled, "The Effect of Size and Weight Limits on Truck Costs" completed in 1991 by Herbert Weinblatt for the FHWA, costs are compared for LCVs on a cost-per-ton basis with those of a standard 53-foot, five-axle combination truck with a gross vehicle weight of 78,000 pounds. It found that:

- A seven-axle, triple 28-foot trailer truck with a gross vehicle weight of 116,000 pounds would be 20 percent more productive; and
- A nine-axle, twin 48-foot trailer truck (turnpike double) with a gross vehicle weight of 127,400 pounds would be 24 percent more productive.

All data shows that it is more efficient and cost-effective, with less wear and tear on the system, if LCVs are allowed.

2.2.5. Truck Platoons and High Occupancy Truck Lanes

Another potential that would make the Corridor more efficient, and would attract additional freight from other congested corridors, is Truck Platooning (TP). TP is a mass flow concept of maximizing the through-put of commercial vehicles on a highway using

physical and/or electronic connections that allow an entire platoon to be controlled as a single unit. The concept offers the benefit of dramatically reducing fuel consumption, eliminating delays caused by congestion on mixed vehicle facilities, and potentially reducing the cost of labor inputs. Most truck platoon concepts being advanced include a dedicated road infrastructure, similar to the TOLs proposed in this application. Benefits of truck platooning include:

- Vehicle Operational Cost Savings: More that 50 percent of the fuel consumed by a typical five-axle tractor-trailer combination is the result of aerodynamic drag. Research estimates that truck platoons can reduce fuel consumption by 10 to 20 percent. Additional research to verify estimates and better understand both energy saving and potential off-setting costs is needed.
- Driver Cost Savings: In the long term, major cost savings could result from driverless trailing vehicles. This would require both significantly improved control technologies and major regulatory changes. In the short term, operational cost savings are possible, if drivers in trailing units are placed in a "non-duty status" with hours of service regulations.
- Infrastructure Saving: Dedicated truck-only facilities, as proposed for I-70, could accommodate significantly higher capacity and greater time reliability using mass flow platoons. The development of a working and effective concept of truck platooning, or any future visionary freight trucking concept, will require what I-70 provides: a long enough distance to make cost savings and investment worthwhile, at a location not so developed as to make it prohibitively expensive to develop TOLs.

2.2.6. Consistent with Trucking Industry Position

As a part of the process to prepare this application, the multistate Coalition contacted, and worked with, the American Transportation Research Institute (ATRI), the research organization affiliated with the American Trucking Associations (ATA). The success of this Corridor will be determined by how well it meets the needs of, and is accepted and used by, the trucking industry.

The trucking industry recognizes the critical need for new road capacity. This is bolstered by Federal Highway Administration statistics which estimate that by 2018, the United States will experience a 70 percent increase in truck tonnage and vehicle miles traveled (VMTs) at the same time that infrastructure capacity increases by three to four percent. That reality forms the basis for the willingness of the trucking industry to fund new capacity – particularly TOLs – with new and/or dedicated revenue sources. It also underpins the opposition of the trucking industry to applying new "alternative funding mechanisms" to existing roadways.

The trucking industry's national association, ATA, has promulgated several policy positions on the use of different revenue collection tools. The general trend for ATA policies is to support maximizing existing revenues, followed by identification of new funding sources

that return a high percentage of the revenue to infrastructure maintenance and capacity development.

Prior to the completion of the SAFETEA-LU legislation, an innovative infrastructure development and funding program called "FAST" (Freeing Alternatives for Speedy Transportation) was introduced in congress that conceptually provided targeted capacity enhancements for projects that met a series of criteria.

The mission of the FAST legislation is:

- To allow new, tolled express traffic lanes on the interstate system. The *federal restrictions on existing capacity/lanes* would continue since a) these provide trucks and cars with the alternative options, and b) there is some rational argument that at least the infrastructure capital of existing lanes has already been paid for with fuel taxes;
- Use of FAST lanes would be *voluntary*;
- FAST lanes would represent *new capacity*;
- Toll collection must be *electronic* and offer freeway-speed processing;
- Toll revenue collected must be *expended on the new capacity*; and
- Tolls would be *eliminated* once the new FAST lane infrastructure capital was paid for.

In summary, the Kennedy amendment dramatically increased the opportunity for states to use tolls for highway financing and congestion management, but it also ensured that tolls would be used in a manner that improves capacity, reduces congestion, and offers productivity options and cost controls (vis-a-vis voluntary usage).

The FAST program, offered as an amendment to the SAFETEA-LU legislation, met all of ATA's transportation policies at the time it was offered, with the most important being the voluntary use component. While not making it into the SAFETEA-LU legislation, it will be presented and re-evaluated for future legislation.

2.3. SOLUTION: MOBILITY THROUGH CONGESTION MITIGATION

The I-70 Corridor is key to Midwest, U.S., and international trade, I-70 is located in the heartland and is grounded by stable industry and developments that ensure and spur economic growth. Timely and reliable trucking is essential to an economy in which businesses keep inventories low and use just-in-time delivery to keep costs down and maintain responsiveness to customers. The increased reliability derived from the added capacity that dedicated truck lanes can provide results in improved responsiveness and less downtime to customers, ultimately translating into reduction in travel costs for the industry.

Although this application is focused on establishing dedicated TOLs along I-70 Corridor, the benefits of the program will be felt not only regionally, but also along parallel corridors that distribute goods nationally. As it stands today, the I-70 Corridor is comparatively less congested than the parallel corridors of I-80, I-90, and I-40. However, according to a study conducted by Texas Transportation Institute (*Current State-of-The-Practice for Managed Lanes*, 2002), the creation of a TOLs facility has the potential to shift truck traffic from more congested parallel roadways to the TOLs Corridor.

A segregated truck and passenger corridor will provide for more efficient movement of goods.

There is no better east-west corridor to facilitate regional congestion relief than I-70. Its central location between I-80/90 and I-40 makes it readily accessible, and its relative level of development makes it more cost-effective to improve. The supporting multimodal infrastructure and crossroads connections make it superior for cost effective multimodal freight movement. It is the intent of the I-70 TOLs Corridor to provide adequate capacity to accommodate and attract trucks from congested parallel corridors where lane additions of this type would not be feasible.

With the I-70 TOLs Corridor, the quality of traveling experience will improve for both passenger cars and commercial vehicles. Large trucks can intimidate motorists traveling in passenger vehicles. It is not unusual for relatively small passenger vehicles to feel boxed in by trucks in front, behind, and alongside them. If all vehicles in the general traffic lanes were roughly the same size, there would be less stress on those motorists who are nervous about sharing the road with large trucks.

TOLs would help improve speeds. Because the acceleration and braking performance of trucks is much lower than that of most passenger vehicles, removing trucks could substantially improve traffic flow on highway segments with heavy traffic. The Transportation Research Board's (TRB's) *Highway Capacity Manual 2000* concludes that one combination truck takes up approximately the same road capacity as 1.8 to eight autos, depending on terrain and traffic conditions. A caveat is, in some instances, improved traffic flow may induce additional traffic.

According to a study conducted by the Texas Transportation Institute (*Current State-of-The-Practice for Managed Lanes*, 2002), truck facilities could have positive impacts on noise and air pollution, fuel consumption, and other environmental issues. Creating and maintaining an uninterrupted flow condition for diesel-powered trucks will result in a reduction of emissions and fuel consumption when compared to congested, stop-and-go conditions.

2.4. SOLUTION: SAFETY

The Federal Motor Carrier Safety Administration's *Large Truck Crash Facts 2003* notes that of all of the crashes involving large trucks and passenger vehicles, a total of 84 percent of fatalities were passengers in those vehicles that were not large trucks. This inequality can

be attributed to the sheer size and mass of large trucks, placing passenger vehicles at a disadvantage in crash incidents. To segregate the two traffic streams would result in less conflict between passenger vehicles and trucks and, consequently, result in fewer crashes where occupants of the passenger vehicles would be exposed to the dangers associated with truck crashes. Separating trucks from passenger vehicles could substantially improve the safety of passenger vehicle travel because approximately 12 percent of all passenger vehicle occupant fatalities occur in crashes with heavy trucks.

A segregated truck and passenger corridor will enhance passenger and truck safety.

Segregated traffic streams also result in a *perceived* safety improvement for truck operators. Truck drivers have a certain degree of anxiety when driving near passenger cars, much like the automobile drivers' concern with trucks. Size of the passenger car, as well as how close a car is to a truck, oftentimes results in the car being in the blind spot of a large truck. From a truck operator's perspective, passenger vehicles can demonstrate less predictable driving patterns than those of other large trucks[1].

With regard to the proposal of developing the I-70 TOLs to accommodate larger trucks, the Federal Motor Carrier Safety Administration's (FMCSA's) *Large Truck Crash Facts 2005* reports, "singles (truck tractors pulling a single semi-trailer) accounted for 62 percent of the large trucks involved in fatal crashes, doubles (tractors pulling two trailers) made up three percent of the large trucks involved in fatal crashes, and triples (tractors pulling three trailers) accounted for 0.1 percent of all large trucks involved in fatal crashes in 2005." This data relates what trucking companies practice, using their safest, most skilled drivers in the heavier trucks, resulting in the best safety records with their LCVs.

TOLs provide unprecedented opportunities for regional, national, and international commerce.

In the event of crash incidents on either the TOLs or passenger vehicle lanes, the employment of dedicated truck lanes provides strategic reliability to ensure ready access in crash incidents and other emergencies: redundant lanes with built-in crossovers will assist in incident management, provide quicker emergency access, and reduce or, in some cases, eliminate the need to shut down segments of the roadway for hours. The redundant lanes also provide opportunities to improve the safety of major construction activities and reduce construction costs and delay by enabling traffic shifts and total or partial shutdown of lanes for construction.

2.5. SOLUTION: TRADE

The trucking industry is the largest sector of the commercial distribution network, carrying approximately 68 percent of all freight tonnage and 88 percent of freight transportation revenue. It is also the most complex and diverse mode, with more than 620,000 interstate firms; 14 million commercial trucks; and 10 million NAICS-categorized

1 *"Public Roads." USDOT, Sept-Oct 2005, p.8.*

employees, of which 3.2 million are large commercial truck drivers. The trucking industry in total is experiencing major economic stress, including intense competition and related rate pressures, high fuel and insurance costs, driver shortages, and new equipment requirements for safety and air quality.

Due in part to these stresses, recent industry data shows the average number of miles driven per truck has decreased in the last two years after decades of steady increases. The cause may be related to increases in congestion, changes in operations, the shift of some long-haul trips to rail intermodalism, or some combination of these factors. However, low barriers to entry and a large (3.2 million mile) network of existing roadways produces a very fluid industry that can accommodate near real-time change. The question is: why isn't this network being fully utilized?

I-70 TOLs will provide an opportunity for the Midwest to have economic security and use the supporting infrastructure in place. Although many drivers see the presence of trucks on the interstate as a nuisance, the fact is, these trucks (i.e., freight) drive the economy. If we are unable to preserve this life line that takes goods to market and provides essential services to each and every person along the Corridor, we are not securing our economic future. As it becomes more and more time consuming and costly for trucking companies to deliver services, the products that consumers buy will also become more costly.

TOL lanes could have an impact on many facets of the landscape and, possibly the most relevant to consumers, the price of goods. According to FHWA, the cost of time for large trucks is higher than the cost of time for small cars, at $25.24 and $15.71 per vehicle hour, respectively. The value of reliability (i.e., the cost of unexpected delay) is another 50 to 250 percent higher than these values of time. This data indicates that as truck operations become more efficient, the cost to the consumer will be reduced. Similarly, the fewer trucks that are on the road, the lower the cost to the consumer.

2.6. DESIGN CONCEPT

At this point it is unknown what shape details of the final I-70 Corridor alternative may take. No design standards have been determined or agreed upon by the corridor states. However, the concept that has gained the most acceptance involves four additional dedicated truck lanes, two lanes in each direction. Alternative or interim solutions may be appropriate at select locations, as will be determined during early engineering and environmental processes.

The following figures provide a schematic for TOLs. The first, **Figure 2-2**, illustrates two dedicated TOLs in each direction, located in the center median with general purpose travel lanes shown on the outside, segregated by a grassy median.

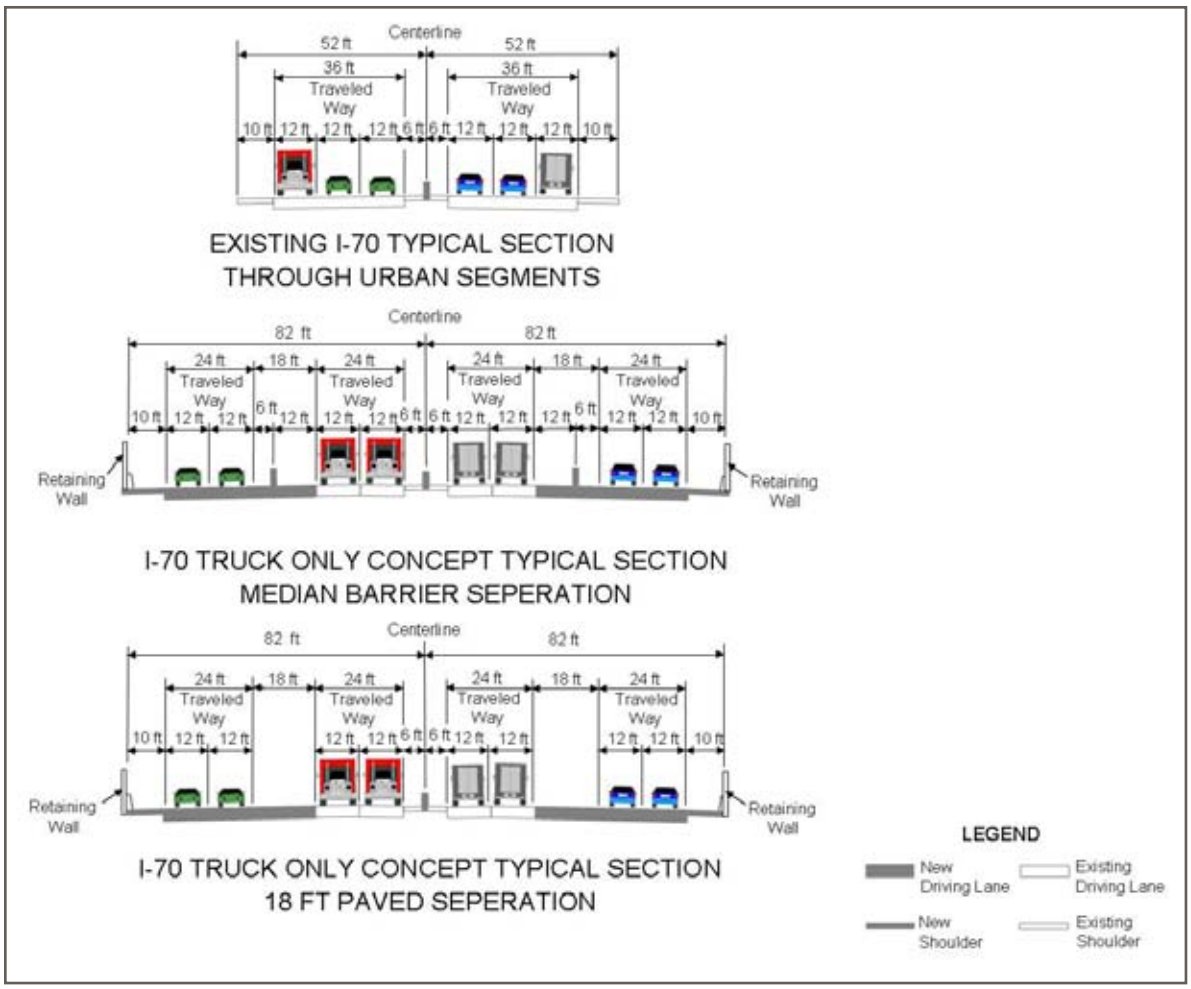
It will not be practical to employ this concept of grass buffers in urban areas. For these areas, TOLs would likely remain in the center of the right-of-way, separated by concrete

median barriers. **Figures 2-3** and **2-4** present other urban and rural typical section options.

Figure 2-2: Median TOLs

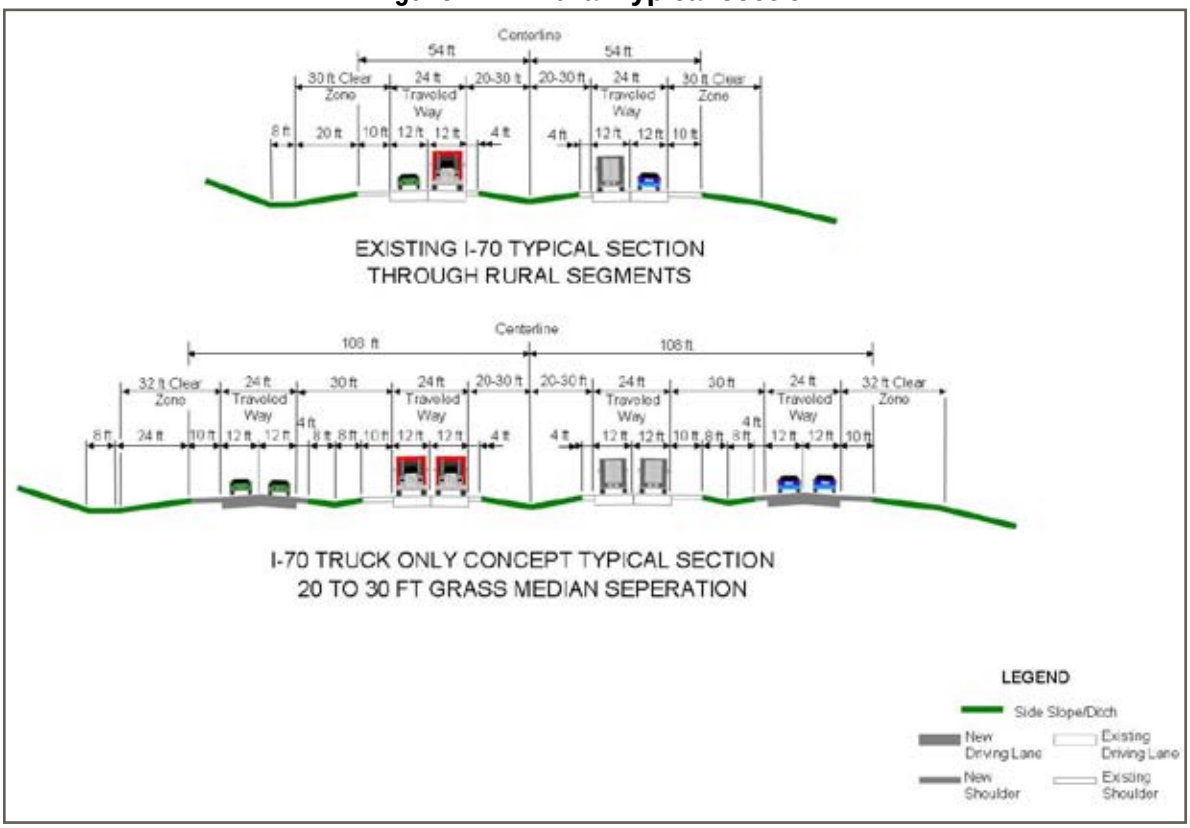
Source: MoDOT, Reconstructing Missouri's Oldest Interstate Highways With Median Truck Lanes

Figure 2-3: Urban Typical Section



Source: Wilbur Smith concept

Figure 2-4: Rural Typical Section



Source: Wilbur Smith concept

2.6.1. Corridor Alignment

While Corridor alignment has been discussed in general in conversations with state DOTs and Metropolitan Planning Organizations (MPOs), until design feasibility and environmental analysis has been completed, it is premature to present any specifics. Current thinking suggests:

- Rural Areas: a first option to be evaluated will consider adding TOLs inside existing lanes or within existing interstate rights-of-way. This will avoid need for major re-alignments or acquisitions of private property.
- Urban Areas: if insufficient right-of-way exists to add TOLs within the existing I-70 Corridor in urban areas, states will explore a number of options including but not limited to adding the TOLs to existing northern or southern beltways; using other existing parallel facilities; etc. All options will be fully explored prior to considering new alignments.

2.7. DESIGN ISSUES

The complexity of the design and operational issues for dedicated truck lanes are greater than those of standard alternatives. The key design feature which enables the benefits listed herein (i.e., improved traffic flow, improved safety, larger loads, reduced congestion, improved construction traffic flow, emergency access, etc.) are all possible because of the physical separation of general purpose traffic lanes (i.e., passenger cars and delivery trucks) from those lanes being used by long-haul commercial vehicles.

Unique design features will ensure safety and efficiency within the corridor.

The standard highway of today is designed to carry a mix of passenger cars and heavy vehicles; however, TOLs will have different design standards applied to them to ensure they can be operated and maintained efficiently over their design life. It is likely that the need to use higher design standards specifically targeted for trucks will result in higher capital costs compared to standard highway construction. However, the general purpose lanes are likely to witness a corresponding reduction in pavement damage associated with heavy truck loads. The design and operational freight efficiencies provided will influence the draw I-70 TOLs have on trucks from other congested trade routes such as I-80, I-90, and I-40. Detailed benefit-cost analyses will need to be conducted to determine the full impact this Corridor will have on the traffic flows and economy of the region.

Design strategies for the four larger urban areas along the Corridor will require additional study to determine the most prudent and feasible alternatives for moving truck traffic around or through the large metropolitan areas of Kansas City, Missouri, St. Louis, Missouri, Indianapolis, Indiana, and Columbus, Ohio. Following is a discussion of some key issues related to the design of TOLs along the I-70 Corridor.

2.7.1. Lack of Truck-Only Facility Design Guidelines

Design guidelines are lacking for the type of truck-only facility proposed in this application. The Texas Transportation Institute's *Truck Accommodation Design Guidance: Final Report* (2003) compares the guidelines that are currently in the *AASHTO Green Book* and the *TxDOT Roadway Design Manual*, and recommends modifications in cases where 2-lane, 2-way exclusive truck lanes are considered. Modifications are recommended for stopping sight distance, intersection and channelization on connecting corridors, lane width, shoulder width and composition, sideslopes and drainage features, traffic barriers, passive signs, and acceleration lanes. Design to accommodate freight movement of the future would likely result in further recommended design modifications. This would take place in consultation with FHWA, AASHTO, the trucking industry, and freight providers.

2.7.2 Geometry/Lane Design

The cross-section proposed for this Corridor contains exclusive TOLs. The *Summary Report on Truck Accommodation Design Guidance* (TTI, 2006), recommends that these facilities

contain no less that two lanes in each travel direction for a variety of common sense and safety reasons. Several TOL technical considerations must also be addressed, including:

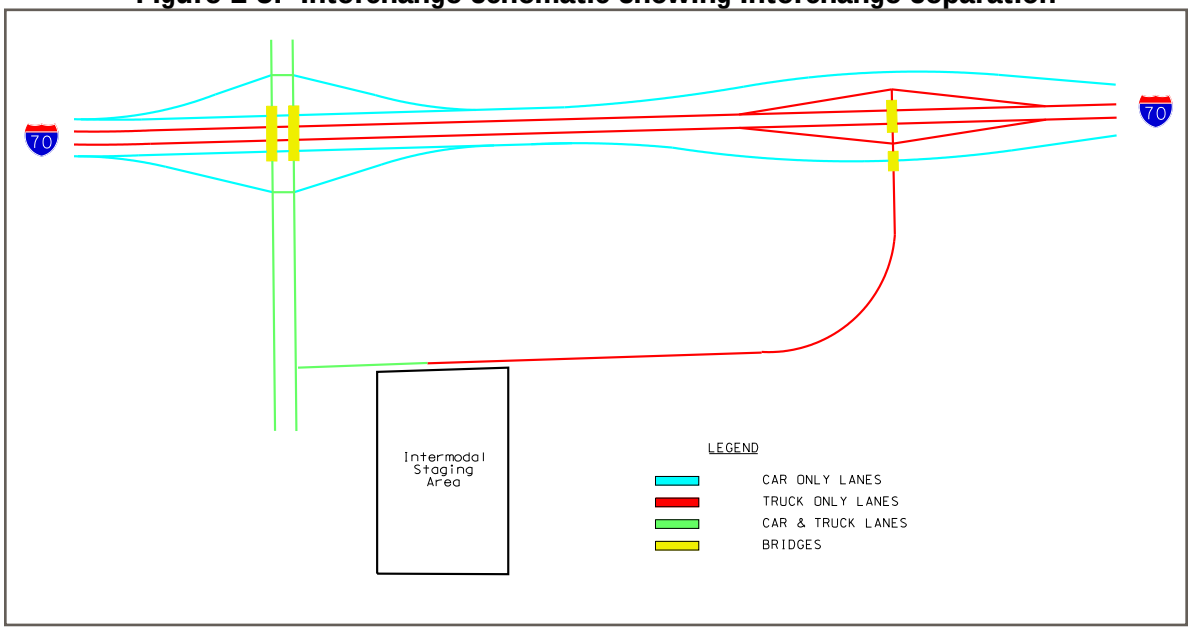
- *Right-of-Way*: It must be recognized that the design of this Corridor will be dependent on available right-of-way. The limited availability of space within urban freeway rights-of-way will likely require compromises to accommodate new lanes within existing freeway cross sections in select urban areas.
- *Wider Lanes and Adequate Shoulders*: Although a wider cross-section is required, lane widths and the need for adequate shoulders will not be compromised. These are necessary to not only accommodate standard long-haul trucks, but also to accommodate additional oversize and overweight vehicles that will likely be drawn to these lanes.
- *Sufficient Separation*: Both lateral and longitudinal physical separation should be addressed in the design to support safe access into, and out of, the facility, as well as appropriate clearance for passing.
- *System Flexibility*: This Corridor will be designed to allow system flexibility. A key advantage of creating separation between travel modes is that in the event of an incident, redundant lanes can serve as a point to ease induced congestion. Built-in crossovers will assist in incident management, reducing (or eliminating) the need to shut down segments of the roadway for hours.

2.7.3 Access Points and Control

Interchange spacing and access control is an element that needs to be carefully designed and appropriately spaced. Access points must be located to allow the entrance/egress of long-haul trucks to the places they need to go; however, they must not be too closely spaced to cause bottlenecks at weaving sections of these locations. This application keeps general and commercial traffic separated at all points along the Corridor, including access points. Each mode will have its own entrance and exit ramps to avoid mixing heavy truck traffic with autos and light trucks. This minimizes exposure between vehicles and maximizes safety benefits.

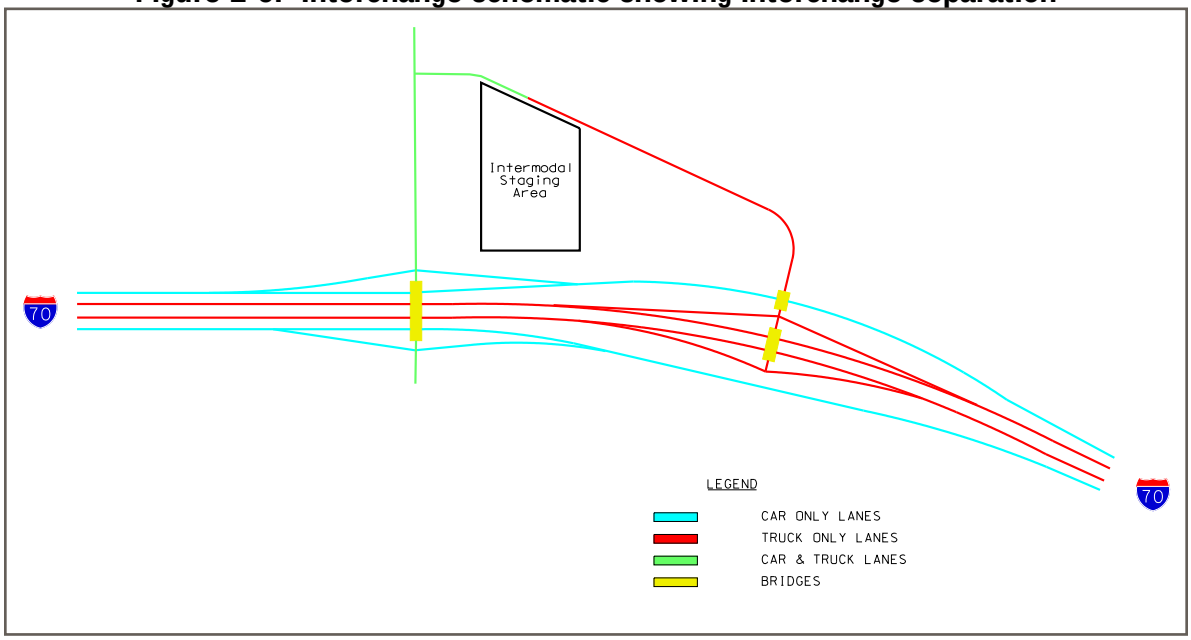
Figure 2-5, 2-6 and **Figure 2-7** provide sample illustrations of how interchanges could be laid out. These were developed for specific purposes at specific locations on this Corridor and are by no means representative of the full spectrum of alternatives that will be considered and evaluated. The examples represent the concept of assigning the truck lanes to the inside of the cross-section. This would minimize the need for complete interchange reconfiguration at any location. For interchanges that do not have truck lane access, a limited amount of construction work will be needed (i.e., new overpass bridges crossing the outer lanes and modification to the tapered ramp terminal). Other interchange options that may be considered include merging trucks and cars on the ramps and at the termini. The best interchange will be selected for the specific location.

Figure 2-5: Interchange Schematic Showing Interchange Separation



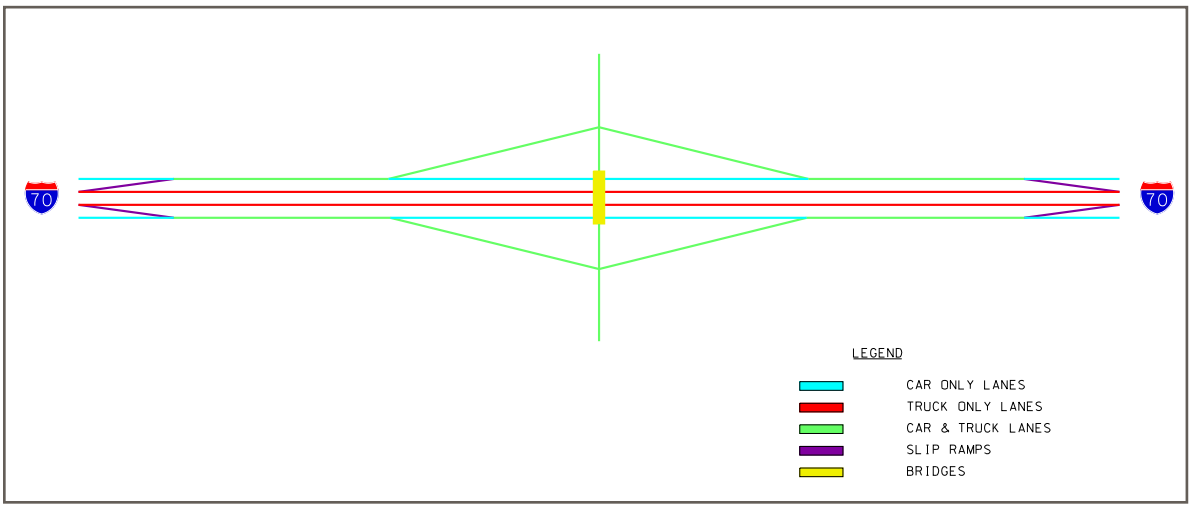
Source: Wilbur Smith concept

Figure 2-6: Interchange Schematic Showing Interchange Separation



Source: Wilbur Smith concept

Figure 2-7: Interchange Schematic Showing Slip Ramp



Source: Wilbur Smith concept

2.7.4. Staging Areas

Appropriately located staging areas are key to the success of this TOL Corridor. Because the TOLs will accommodate LCVs and trucks with higher weight and size thresholds (i.e., weights and sizes that are not currently allowed along interstates or other connecting roadways), staging areas will be needed to accommodate the "breaking down" of doubles or triples to single truck units for travel from/to their origin/destinations.

A comprehensive study will be conducted that reviews the major industries in the Corridor (i.e., FedEx in Indianapolis, Rickenbacker Global Logistics Park in Columbus, etc.) and then recommends appropriate locations for staging areas that best serve commerce. At a minimum, staging areas will be located at the beginning/ending points of the Corridor, and at interstate interchanges. The study will determine at what other major highways, major cities or emerging industrial areas additional staging yards will be required. In some cases, these staging yards will be colocated with public and private roadside parking facilities and weigh stations.

2.8. COST CONSIDERATIONS

Irrespective of future design, the need to use design standards that are specifically targeted for the trucks of today, or the future, will result in higher capital costs compared to standard highway construction. As stated, depending upon the utilization of truck lanes, the general purpose lanes will also witness a reduction in pavement damage associated with heavy truck loads.

Section 3.3 and **Appendix D** provide planning level cost estimates for constructing the TOLs facilities through both urban and rural segments of the Corridor.

2.9. OTHER STRATEGIES TO BE ENABLED

Ultimately, production efficiency in the trucking industry equates to quantity of freight moved and number of trips completed within a given time frame. For a TOLs facility, efficiency and safety automatically increase simply through the elimination of truck and passenger vehicle interaction and weave movements.

Now, consider the potential efficiencies when adding any or all of the following features made possible by a TOLs facility:

- Pavement designs accommodating heavier loads per vehicle or axle;
- Geometric and safety features enabling potentially faster travel speeds;
- Significantly reducing construction and incident delays (35 percent of all congestion) due to information technologies and the ability to cross-over traffic to adjoining travel lanes during construction or major incidents;
- Safely carrying wider or longer loads that enable manufacturers and shippers to rethink their shipping and assembly processes;
- Developing new technologies that would not otherwise be feasible or practical, if not for the size of the Corridor (e.g., truck platoons, high speed electronically controlled vehicle operations, truck trains that move cabs between yards on an automated conveyance system where they are assembled and disassembled, etc.).

Design is not proposed to feature undeveloped technologies or brainstorms. However, this Corridor could certainly provide a unique platform for the investigation of developing technologies. The cost of these future technologies is not included in the cost estimates presented in **Section 3.3**.

Beyond the design and construction of dedicated TOLs, a number of operational and Intelligent Transportation Systems (ITS) strategies will be incorporated into the project to further reduce congestion and improve mobility and safety.

The Missouri, Illinois, Indiana and Ohio DOTs will work with the FHWA in continued consultation with the American Trucking Association and engaging industrial freight shippers, information technology transportation researchers, and the rail and container shipping industries that provide and receive truck freight. The input of all stakeholders in the freight industry will be considered in the design and development of the I-70 TOLs "Corridor of the Future."

Although proper facility design is essential to the success of the facility, also important are the operational strategies used throughout the Corridor. *Managed Lanes, A Primer* (FHWA)

suggests various operational strategies be reviewed prior to implementation/operation including:

- Integrated Transportation Opportunities and Technology;
- Roadside Parking; and
- Tolling Options/Congestion Pricing.

These issues and options are under consideration by the state DOT's as they discuss the design and development of the dedicated TOLs on I-70. Following is an overview of the current thinking on these issues and options as they relate to this project.

2.10. ITS INTEGRATION

ITS help transportation networks work in the most effective and efficient way possible through the use of technology applications.

From a freight perspective, ITS helps shippers/carriers move goods to destinations reliably while improving traffic flow, reducing delays, improving fuel consumption, and minimizing air and noise pollution. There exist specific technologies developed for the sole use of commercial vehicle fleets. Installation of sufficient traffic management, monitoring and control devices is key to enabling agencies to make real-time operational decisions.

The I-70 TOLs project can serve as a Pilot Corridor for Federal ITS Integration activities.

The following are several state-of-the-practice ITS applications to be examined for potential application on the I-70 Corridor in order to provide additional mobility efficiencies to the TOL concept, as well as the traveling public.

2.10.1. Advanced Traffic Management Systems

Advanced Traffic Management Systems (ATMS) are the backbone for other ITS applications, providing the means for data collection. ATMS provide eyes-on-the-road information via detection devices, cameras, and communication systems which monitor traffic, optimize signal timings on connecting arterials, and improve the flow of traffic.

Each of the I-70 Corridor states is pursuing ATMS systems of one type or another and operating those systems via Transportation Management Centers (TMCs). TMCs are the heart of system data collection and the point of operations for freeway management systems. TMCs process the myriad of data collected and then produce information that gets distributed to stakeholders such as the media, other agencies, and the traveling public. TMCs are also where agencies can coordinate their responses to incidents. Participating states would assess their operational and technological compatibilities to enable connecting state TMCs virtually, in order to share information across state lines and operate the Corridor seamlessly.

Example of Benefits: A combination of ITS technologies in Detroit, Michigan - including advanced traveler information systems, highway advisory radio, ramp metering, and variable message signs - increased average vehicle speeds by 8.7 kilometers per hour (5.4 mph), decreased trip times by 4.6 minutes, and reduced commuter delay by 22 percent. (*Traffic Congestion Factoids*, FHWA, 2006)

2.10.2. Traveler Information

Advanced Traveler Information Systems deliver data directly to travelers, enabling them to make better choices about alternate routes or modes of transportation. Information can be reviewed pre-trip, or while en route, enabling travelers to make "on-the-fly" adjustments based on real-time traffic conditions.

Driver information and signing can be extremely useful, if located in ways travelers can readily access it. Information portals can be developed to link travel, incident, road construction and weather condition information on the Corridor. Information can then be pushed to dynamic message signs, web portals at truck stops, freight transfer facilities, rest stops, or handheld devices. This information can also be pulled from established "511" systems, the universal 3-digit telephone number, to provide one-stop shop access for travel and traffic information. An integrated multistate corridor ITS system, in conjunction with separated truck and vehicle lanes, will present an exceptional opportunity for this Corridor to minimize incident- and construction-related congestion in particular. ITS systems combined with crossovers will also allow for routing traffic onto the adjoining lanes in these circumstances.

2.10.3. Emergency Management

Emergency management systems provide traffic operators with the tools to allow quick and efficient response to incidents, hazardous spills, and other emergencies. These systems can automatically contact a call center when a driver presses a button or an airbag deploys.

Not all emergency management systems are "technology based." One example is the deployment of freeway service patrols that quickly clear blockages. The development of incident management plans that identify alternate routes in the event of closures is key to keeping routes clear so that emergency management vehicles can enter the scene. As noted previously, redundant lanes will also facilitate easy traffic re-routing, as well as emergency response.

2.10.4. Commercial Vehicle Operations

ITS will enable more reliable and timely commercial vehicle management. ITS will automatically keep track of HAZMAT and other red flag information about the vehicle and its cargo. ITS will help communicate this information to the authorities so that vehicles can be cleared through checkpoints without stopping, as appropriate.

At the federal level, the Commercial Vehicle Information Systems and Networks (CVISN) program has been developed and is beginning to be deployed. The I-70 Corridor could serve as a pilot corridor for this initiative. The Federal Motor Carrier Safety Administration has developed the CVISN program to be a coordinating portal for information systems owned and operated by governments, motor carriers, and other trucking stakeholders. The focus of this effort is on being a nationwide one-stop shop for commercial vehicle safety information, e-credentialing, and e-screening.

Example of Benefits: Coordinating a Midwest CVISN deployment for the I-70 Corridor would streamline the screening/credentialing process for the four states involved, saving all states time and money. In fact, carriers commissioned new vehicles 60 percent faster by printing their own electronic credential paperwork and not waiting for conventional mail delivery, and motor carriers surveyed indicated CVISN electronic credentialing reduced paperwork and saved them 60 to 75 percent on credentialing costs (ITS Benefits Database, FHWA).

Weigh-in-Motion/Virtual Weigh-in-Motion Technology: Weigh-in-motion technology will be assessed as another means to reduce travel times for truck drivers by reducing delay. In conjunction with the ability to design a corridor to accommodate heavier loads, weigh-in-motion technology also offers the opportunity for a unique financing mechanism. Opportunities for variable tolling mechanisms will be assessed, one of which could be offering freight carriers the option of paying variable tolls for the ability to carry heavier loads, with the toll rate dependent on weight.

2.10.5. Advanced Vehicle Safety Systems

The Vehicle Infrastructure Integration (VII) program is a joint effort between the USDOT and the automobile industry to develop an information infrastructure that uses advanced communications to exchange real-time information between the roadside and vehicles to improve safety and mobility. Examples of technologies that could improve safety within the I-70 Corridor include:

- Automated Crash Notification Systems to transmit crash information to responders;
- Rear-End Collision Avoidance Systems to sense the presence and speed of vehicles ahead and provide warnings to avoid collisions; and
- Road Departure Collision Avoidance Systems to track the lane or road edge and suggest safe speeds for the road ahead.

The addition of dedicated truck lanes over the length of the Corridor could serve as a testing ground for even more advanced technologies in the future for both trucking and passenger vehicles.

2.10.6. Electronic Toll Collection/Congestion Pricing

This technology allows tolls to be collected electronically, usually without the need for costly vehicle stops and queuing. Violation enforcement is possible through video imaging; and, in some cases, video imaging can be used for electronic tolling itself.

Because tolling is done electronically, it is easy to adjust the fees collected and charge variable rates based on vehicle, as well as implement demand management strategies. Each participating trucking firm would maintain a prepaid account with the toll operator from which tolls would be deducted based on recorded miles driven from entry point to exit point on the tollway. Through automatic vehicle classification systems, it would be possible to dynamically identify vehicle size and weight category.

Tolling is just one of many financing options for the proposed I-70 TOLs. Tolling can also be utilized in combination with other funding mechanisms, as discussed further in **Section 3.3**. Most innovative financing techniques raise concern with various segments of the populous. However, a corridor of this length, designed to accommodate trucking of the future, enables a variety of potential unique incentives for financing and electronic tolling in particular.

Given the length of the Corridor, the potential TOLs would be extremely attractive to truckers, if significant opportunities for increased efficiency were introduced. The trucking industry itself has expressed a willingness to pay relatively significant tolls in return for sizable improvements in efficiency.

For example, one possibility might be to allow full "Turnpike Doubles" and/or other similar arrangements where one driver/cab might be able to pull two full-sized trailers over extended distances. This would greatly reduce the cost for operators, as compared with two drivers pulling the two trailers; and operators would be willing to pay to gain these efficiencies. In its simplest forms, allowing for turnpike doubles, triple trailer trucks, or heavier loads in conjunction with weigh-in-motion monitoring, variable tolling for a corridor of this length would support a design where truck operators might be given options to pay for efficiency. Dependent on the design, they might choose to pay in order to take advantage of greater efficiencies in weight, truck size, and speed.

In the spirit of a true "Corridor of the Future," newly evolving traffic operations, navigational, vehicle and design safety technologies may one day provide the means to safely and efficiently move trucks at much higher speeds. Such improvements are likely to take place incrementally. Improvements in one technology would require improvements in others, just as the interstate design standards of today have evolved to address changes in vehicle design and operational speeds. Similar changes have taken place in many transportation technologies.

Given the challenges of addressing large truck size and weight in all aspects of operational design, no significant improvement in truck speed efficiency is likely practical without segregated truck corridors. Such corridors would also likely need to be lengthy in order

to make the investment and potential time savings worthwhile. However, no such opportunities are likely to ever be realized without a "Corridor of the Future" suited to first apply the early incremental changes that will move the industry forward.

2.10.7. Need for Corridor ITS Architecture

The I-70 Corridor travels through four major MPO areas, each of which has been required to develop a regional ITS architecture. Similarly, each state possesses a statewide ITS architecture, outlining their respective visions for ITS deployment. Because each area has varying needs, architectures between regions and states will vary. As this project moves forward, the states will look at opportunities for developing an ITS architecture specific to the Corridor that can be integrated into existing systems to provide consistency for motorists traveling the I-70 Corridor.

2.11. ROADSIDE PARKING

Inadequate roadside parking for trucks can lead to serious safety concerns. Lack of parking prompts tired truck drivers to continue driving in search of parking down the road or park in unsafe areas (i.e., exit ramps and shoulders). These situations are unsafe for truck drivers and the driving public alike. The development of TOLs will separate truck/automobile movements and provide additional safe truck parking via staging areas.

The FHWA's *Study of Adequacy of Commercial Truck Parking Facilities - Technical Report* (2002) surveyed drivers regarding parking needs and decision making, developed an inventory of National Highway System (NHS) parking facilities, and determined projected shortages in roadside parking facilities. The study found that after Texas and California, the applicant states of Indiana, Illinois, and Ohio had the greatest truck parking needs. **Table 2-2** illustrates FHWA's calculation of the truck parking demand/supply ratios for the I-70 Corridor states.

Table 2-2: Truck Rest Area Parking Space Utilization

	Public (Rest Areas)		Commercial (Truck Stops)		Total	
State	Ratio	Category	Ratio	Category	Ratio	Category
Missouri	4.28	Shortage	0.72	Surplus	0.89	Surplus
Illinois	2.63	Shortage	1.16	Shortage	1.33	Shortage
Indiana	1.77	Shortage	0.99	Sufficient	1.10	Shortage
Ohio	2.35	Shortage	0.96	Sufficient	1.12	Shortage

A roadside parking management plan (smart parking) developed in concert with the I-70 Corridor will provide additional designated parking locations and contribute to overall user safety. Providing "yellow page" type information on where designated locations are within the Corridor via web pages, rest area postings, dynamic message signs, and hand-held devices will be part of the solution.